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| **UNIT 8: Transformations; Constructions: triangles, nets, plan and elevation, loci, scale drawings and bearings** |

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**SPECIFICATION REFERENCES**

R2 use scale factors, scale diagrams and maps

R6 express a multiplicative relationship between two quantities as a ratio or a fraction

G2 use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle); use these to construct given figures and solve loci problems; know that the perpendicular distance from a point to a line is the shortest distance to the line

G3 apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles; understand and use alternate and corresponding angles on parallel lines; derive and use the sum of angles in a triangle (e.g. to deduce and use the angle sum in any polygon, and to derive properties of regular polygons)

G5 use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS)

G7 identify, describe and construct congruent and similar shapes, including on a coordinate axis, by considering rotation, reflection, translation and enlargement (including fractional **and negative** scale factors)

G8 **describe the changes and invariance achieved by combinations of rotations, reflections and translations**

G12 identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres

G13 construct and interpret plans and elevations of 3D shapes

G15 measure line segments and angles in geometric figures, including interpreting maps and scale drawings and use of bearings

G24 describe translations as 2D vectors

G25 apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors; …

**PRIOR KNOWLEDGE**

Students should be able to recognise 2D shapes.

Students should be able to plot coordinates in four quadrants and linear equations parallel to the coordinate axes.

**KEYWORDS**

Rotation, reflection, translation, transformation, enlargement, scale factor, vector, centre, angle, direction, mirror line, centre of enlargement, describe, distance, congruence, similar, combinations, single, corresponding, constructions, compasses, protractor, bisector, bisect, line segment, perpendicular, loci, bearing

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| **8a. Transformations** (R6, G5, G7, G8, G24, G25) | **Teaching time**5-7 hours |

**OBJECTIVES**

By the end of the sub-unit, students should be able to:

* Distinguish properties that are preserved under particular transformations;
* Recognise and describe rotations – know that that they are specified by a centre and an angle;
* Rotate 2D shapes using the origin or any other point (not necessarily on a coordinate grid);
* Identify the equation of a line of symmetry;
* Recognise and describe reflections on a coordinate grid – know to include the mirror line as a simple algebraic equation, *x* = *a*, *y* = *a*, *y* = *x*, *y* = –*x* and lines not parallel to the axes;
* Reflect 2D shapes using specified mirror lines including lines parallel to the axes and also
*y* = *x* and *y* = –*x*;
* Recognise and describe single translations using column vectors on a coordinate grid;
* Translate a given shape by a vector;
* Understand the effect of one translation followed by another, in terms of column vectors (to introduce vectors in a concrete way);
* Enlarge a shape on a grid without a centre specified;
* Describe and transform 2D shapes using enlargements by a positive integer, positive fractional, and negative scale factor;
* Know that an enlargement on a grid is specified by a centre and a scale factor;
* Identify the scale factor of an enlargement of a shape;
* Enlarge a given shape using a given centre as the centre of enlargement by counting distances from centre, and find the centre of enlargement by drawing;
* Find areas after enlargement and compare with before enlargement, to deduce multiplicative relationship (area scale factor); given the areas of two shapes, one an enlargement of the other, find the scale factor of the enlargement (whole number values only);
* Use congruence to show that translations, rotations and reflections preserve length and angle, so that any figure is congruent to its image under any of these transformations;
* Describe and transform 2D shapes using combined rotations, reflections, translations, or enlargements;
* Describe the changes and invariance achieved by combinations of rotations, reflections and translations.

**POSSIBLE SUCCESS CRITERIA**

Recognise similar shapes because they have equal corresponding angles and/or sides scaled up in same ratio.

Understand that translations are specified by a distance and direction (using a vector).

Recognise that enlargements preserve angle but not length.

Understand that distances and angles are preserved under rotations, reflections and translations so that any shape is congruent to its image.

Understand that similar shapes are enlargements of each other and angles are preserved.

**OPPORTUNITIES FOR REASONING/PROBLEM SOLVING**

Students should be given the opportunity to explore the effect of reflecting in two parallel mirror lines and combining transformations.

**COMMON MISCONCEPTIONS**

Students often use the term ‘transformation’ when describing transformations instead of the required information.

Lines parallel to the coordinate axes often get confused.

**NOTES**

Emphasise the need to describe the transformations fully, and if asked to describe a ‘single’ transformation students should not include two types.

Find the centre of rotation, by trial and error and by using tracing paper. Include centres on or inside shapes.

Area of similar shapes is covered in unit 12.